ETSI TS 122 085 V13.0.0 (2016-01)

TECHNICAL SPECIFICATION

Digital cellular telecommunications system (Phase 2+);
Universal Mobile Telecommunications System (UMTS);
Closed User Group (CUG) supplementary services;
Stage 1
(3GPP TS 22.085 version 13.0.0 Release 13)

Reference

RTS/TSGS-0122085vd00

Keywords

GSM,UMTS

ETSI

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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y   the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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0 Scope

The present document describes the Supplementary Services belonging to the group Community Of Interest Supplementary Services.

The general aspects, including definitions and recommended provision, of the description of the Supplementary Services are given in TS 22.004.

The group of Community Of Interest Supplementary Services includes one Supplementary Service:

- Closed user group (clause 1).

0.1 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1]   3GPP TS 21.905: "Vocabulary for 3GPP Specifications".

[2]   3GPP TS 22.004: "General on Supplementary Services".

[3]   3GPP TS 23.003: "Digital cellular telecommunications system (Phase 2+); Numbering, addressing and identification".

[4]   ITU-T Recommendation X.121: "International numbering plan for public data networks".

[5]   ITU-T Recommendation X.180: "Administrative arrangements for closed user groups (CUGs)".

[6]   3GPP TS 22.088: 'Call Barring (CB) supplementary services – Stage 1'.

0.2 Abbreviations

Abbreviations used in the present document are listed in 3GPP TS 21.905 [1].

1 Closed User Group (CUG)

1.1 Definition

The Closed User Group (CUG) Supplementary Service enables subscribers, connected to a PLMN and possibly also other networks, to form closed user groups (CUGs) to and from which access is restricted. A specific user may be a member of one or more CUGs. Members of a specific CUG can communicate among each other but not, in general, with users outside the group.

The ability to set up emergency calls remains unaffected.

1.2 Description

1.2.1 Service description

An ISDN/MSISDN number shall identify each member of a CUG.

A CUG shall be defined for one or more basic service groups.

CUG members can have additional capabilities that allow them to originate calls outside the group, and/or to receive calls from outside the group. CUG members can have additional restrictions that prevent them from originating calls to other members of the CUG, or from receiving calls from other members of the CUG.

CUG shall remain unaffected when members roam to PLMNs supporting CUG. Roaming subscribers must have the same CUG facilities on the roamed-to PLMN as on the Home PLMN.

When roaming to networks not supporting CUG, the CUG restrictions must be enforced. (However, where possible, the CUG facilities should be supported, see subclause 1.4.10.)

Each individual subscriber may be a member of a maximum of 10 CUGs.

1.2.2 Applicability to telecommunication services

The applicability of this Supplementary Service is defined in 3GPP TS 22.004 [2].

1.2.3 Definitions

MSISDN: A number conforming to the numbering plan and structure specified in 3GPP TS 23.003.

CUG member: A user who has subscribed to the CUG Supplementary Service and is one of the users in the group formed by a particular CUG.

CUG index: A value assigned by the network to identify a CUG.

CUG Interlock Code (IC): Is used by the network (not by the MS) to identify CUG membership.

preferential CUG: A preferential CUG, which can be specified for each basic service group, is the nominated default CUG to be used when no explicit CUG index is received by the network.

suppress preferential CUG: A user action to prohibit the use of the preferential CUG, on a per call basis.

Incoming Access (IA): An arrangement which allows a member of a CUG to receive calls from outside the CUG.

Outgoing Access (OA): An arrangement which allows a member of a CUG to place calls outside the CUG.

suppress OA: A user action to prohibit the use of the OA subscription option, on a per call basis.

Incoming Calls Barred Within A CUG (ICB): An access restriction that prevents a CUG member from receiving calls from other members of that group.

Outgoing Calls Barred Within A CUG (OCB): An access restriction that prevents a CUG member from placing calls to other members of that group.

CUG calls: A CUG call is a call which is restricted to a pre-defined group of users.

1.3 Normal procedures with successful outcome

1.3.1 Provision

The CUG Supplementary Service shall be provided after prior arrangement with the service provider.
At provision subscription options should be selected by the served mobile subscriber.

A user may be a member of several CUGs. The service provider defines the number of CUGs, up to the maximum stated in subclause 1.2.1, which can be allocated to an individual subscriber.

The user shall choose one of the following subscription options for each basic service group applied to the CUG Supplementary Service. This subscription option may be provisioned on a per basic service group basis or for all basic services:

- CUG calls only;

- CUG with incoming access, i.e. can also receive calls, which are not subject to CUG restrictions;

- CUG with outgoing access, i.e. can also make calls, which are not subject to CUG restrictions;

- CUG with incoming and outgoing access, i.e. can also make and receive calls, which are not subject to CUG restrictions.

A user may subscribe to one of two additional restrictions applying for each particular CUG:

- incoming calls barred within a CUG;

- outgoing calls barred within a CUG.

The network shall provide a subscription option in order to enable the user to specify a preferential CUG, for each basic service group included in at least one of the CUG(s). The user can request that no preferential CUG exists, or that a particular one of her CUGs (or the only one if a single CUG applies) is used as a preferential CUG for the particular basic service group.

If a user has the subscription option outgoing calls barred within a CUG, it is not allowed to specify that particular CUG as a preferential CUG.

The subscription options are shown in Annex 1.

The CUG indices shall be allocated by prior arrangement with the service provider.

The choice of preferential CUG(s) shall be alterable only by service provider action upon request by the served user.

1.3.2 Withdrawal

Withdrawal of the CUG Supplementary Service, membership of one or more CUGs, will be by the action of the service provider, at the request of the subscriber or CUG management, or for administrative reasons.

1.3.5 Activation

The CUG Supplementary Service will be activated by the service provider as a result of provision.

1.3.6 Deactivation

The CUG Supplementary Service will be deactivated by the service provider as a result of withdrawal.

1.3.7 Invocation

Normal call setup procedures shall apply to calls with the CUG Supplementary Service.

1.3.8 Normal operation with successful outcome

A user having neither the restriction of incoming calls barred within a CUG, nor the restriction of outgoing calls barred within a CUG can make calls to, and receive calls from, members of those CUGs of which the user is a member.

Upon receipt of a call setup attempt to or from a CUG subscriber the network shall check its validity in conjunction with the access capabilities subscribed to.

On successful validation of a CUG call setup attempt the network shall attempt to establish the call to the required destination.

1.3.8.1 Mobile originating calls

When originating a call, the calling user may specify a CUG index to indicate that service to a particular CUG is required. If no CUG index is given then the preferential CUG (if specified) is used by the network.

The Outgoing Access (OA) capability allows CUG subscribers to make outgoing calls, which are not subject to CUG restrictions.

If a user, subscribing to the CUG Supplementary Service, originates a call and enters a request for suppression of both a preferential CUG and of the OA capability but does not enter a CUG index, the call shall be rejected.

If a user, subscribing to the CUG Supplementary Service and having the OA capability, originates a call and enters a CUG index (without suppressing the OA capability), while having the restriction of outgoing calls barred within that CUG, the call shall be established without any CUG information i.e. as a normal call.

The originating PLMN actions are illustrated in annex 2.

As a network option, the network may signal towards the calling user the CUG index in use for the current call, if this can be determined by the network.

1.3.8.1.1 A user with no preferential CUG and no OA capability

If a user, subscribing to the CUG Supplementary Service, who has no preferential CUG and no OA capability, originates a call and enters a CUG index (and possibly requests suppression of a preferential CUG and/or the OA capability) the call shall be established using the CUG index provided. If no CUG index is entered the call shall be rejected.

1.3.8.1.2 A user with a preferential CUG but no OA capability

If a user, subscribing to the CUG Supplementary Service, who has a preferential CUG but no OA capability, originates a call and enters no CUG information (or if she only requests suppression of the OA capability),the call shall be established using the preferential CUG. If she enters a CUG index (and possibly a request for suppression of the preferential CUG and/or the OA capability), the call shall be established using the CUG index provided. If she enters only a request for suppression of the preferential CUG, i.e. no CUG index, the call shall be rejected.

1.3.8.1.3 A user with the OA capability but no preferential CUG

If a user, subscribing to the CUG Supplementary Service, who has the OA capability but no preferential CUG, originates a call and enters no CUG information (or if she only requests suppression of a preferential CUG), the call shall be established without any CUG information being sent, i.e. this is set up as a normal call. If she enters a CUG index (and possibly a request for suppression of a preferential CUG), the call shall be established using the CUG index provided and with an indication of OA allowed. If she enters both a CUG index and a request for suppression of the OA capability (and possibly a request for suppression of a preferential CUG), the call shall be established using the CUG index provided. If she enters only a request for suppression of the OA capability, i.e. no CUG index, the call shall be rejected.

1.3.8.1.4 A user with a preferential CUG and the OA capability

If a user, subscribing to the CUG Supplementary Service, who has a preferential CUG and the OA capability, originates a call without any CUG information, the call shall be established using the preferential CUG and with an indication of OA allowed. If she enters a CUG index (and possibly a request for suppression of the preferential CUG), the call shall be established using the CUG index provided and with an indication of OA allowed. If she enters only a request for suppression of the OA capability, the call shall be established using the preferential CUG. If she enters only a request for suppression of the preferential CUG, i.e. no CUG index, the call shall be established without any CUG information i.e. this is set up as a normal call. If she enters both a CUG index and a request for suppression of the OA capability (and possibly a request for suppression of the preferential CUG), the call shall be established using the CUG index provided.

1.3.8.1.5 A user not subscribing to the CUG Supplementary Service

If a user, not subscribing to the CUG Supplementary Service, originates a call and enters CUG information the call shall be set up as a normal call.

1.3.8.2 Mobile terminating calls

If a user, with or without the IA capability, receives a CUG call and the calling user is a member of the same CUG, the incoming CUG call shall be indicated as such, towards the called Mobile Station, with the appropriate CUG index.

If a user with the IA capability receives a call from a user who has not subscribed to the CUG Supplementary service, or from a user who is a member from another CUG and who is using the OA capability, the call is offered to the user as a normal incoming call.

The terminating PLMN actions are illustrated in annex 3.

1.3.8.2.1 CUG call with no OA indication

For a call where an interlock code is received, but not an indication of OA allowed, the following applies:

If there is a match with any of the called user's CUGs, and if she does not have incoming calls barred within this CUG, the call shall be offered as a CUG call. In all other cases the call shall be rejected.

1.3.8.2.2 CUG call with OA indication

For a call where both an interlock code and an indication of OA allowed is received, the following applies:

If there is a match with any of the called user's CUGs, and if she does not have incoming calls barred within this CUG, the call shall be offered as a CUG call.

If the above condition does not apply, and if she has incoming access allowed, the call shall be offered as a normal call.

If the called subscriber does not subscribe to the CUG Supplementary Service, the call shall be offered as a normal call.

In all other cases, the call shall be rejected.

1.3.8.2.3 Normal call

When a normal call is received, i.e. a call without any CUG information, the following shall apply:

If the called subscriber subscribes to the CUG Supplementary Service and has incoming access allowed, or if she is a normal non-CUG subscriber, the call shall be offered as a normal call. In all other cases, the call shall be rejected.

1.4 Exceptional procedures or unsuccessful outcome

1.4.1 Exceptional operation or unsuccessful outcome

Upon receipt of a call setup attempt to or from a CUG subscriber, the network shall check its validity in conjunction with the access capabilities subscribed to. If an invalid request is received or the checks cannot be performed, then the network shall reject the call and return an appropriate indication to the calling user.

The network shall prohibit a user with incoming calls barred within a CUG from receiving CUG calls from members of the same CUG.

The network shall prohibit a user with outgoing calls barred within a CUG from making CUG calls within that CUG.

1.4.10 Roaming into networks not supporting CUG

The HPLMN shall control handling of roaming, when a CUG subscriber is roaming into a network not supporting CUG, without relying on extra functionality in network entities not supporting CUG.

For subscribers roaming in a PLMN not supporting CUG the following apply:

1) In the case of basic service groups not subject to CUG restrictions, incoming and outgoing calls shall be allowed as normal.

2) In the case of basic service groups subject to CUG restrictions and without incoming access, incoming calls shall not be allowed.

3) In the case of basic service groups subject to CUG restrictions and without outgoing access, outgoing calls shall not be allowed.

4) Normal incoming calls are allowed for basic service groups subject to CUG restrictions and for which the called user has incoming access allowed.

5) Outgoing calls are allowed for basic service groups subject to CUG restrictions and for which the user has outgoing access allowed.

1.5 Alternate procedures

None identified

1.6 Interactions with other Supplementary Services

1.6.82.1 Call forwarding unconditional

CUG restrictions shall be met between the calling user and the forwarding user. In addition, the call must not be forwarded if the CUG restrictions of the forwarding mobile subscriber forbid her to make a call attempt of the same type to the forwarded-to user. The parameters of the CUG requested by the calling user shall be used for the forwarding call, and by this means CUG restrictions shall be met between the calling user and the forwarded-to user, except for the cases stated in section b) below.

Annex 4 shows under what circumstances a call shall be allowed to be forwarded.

a) CUG call with no OA indication.

For calls received with an IC, but no indication of OA allowed, the following is valid:

If the forwarding subscriber subscribes to the CUG Supplementary Service, and if she does not have outgoing calls barred within the CUG, the call shall be forwarded with the same IC as received from the A-party. In all other cases, the call shall be rejected.

b) CUG call with an indication of OA allowed.

For calls received with an IC and an indication of OA allowed, the following is valid:

If the forwarding subscriber subscribes to the CUG Supplementary Service, and if there is a match with any of her CUGs, and if she does not have OA allowed, and if she does not have outgoing calls barred within the CUG, then the call shall be forwarded with the same IC as received from the A-party (the indication of OA allowed shall in this case NOT be forwarded).

If the forwarding subscriber subscribes to the CUG Supplementary Service, and if there is a match with any of her CUGs, and if she does have OA allowed, and if she does not have outgoing calls barred within the CUG, then the call shall be forwarded with the same IC as received from the A-party and with the indication of OA allowed. If this forwarding subscriber has outgoing calls barred within the CUG, then the call shall be forwarded as a normal call (the CUG information shall in this case NOT be forwarded).

If the forwarding subscriber subscribes to the CUG Supplementary Service, and if there is no match with any of her CUGs, but if she has IA allowed and OA allowed, then the call shall be forwarded with the same IC as received from the A-party and with the indication of OA allowed (in this case the subscription option "Intra-CUG restrictions" is not relevant).

If the forwarding subscriber does not subscribe to the CUG Supplementary Service, then the call shall be forwarded with the same IC as received from the A-party and with the indication of OA allowed.

In all other cases, the call shall be rejected.

    c) Normal call.

For normal calls received the following is valid:

If the forwarding subscriber subscribes to the CUG Supplementary Service, and if she does have OA allowed, then the call shall be forwarded without any CUG data. (In this case the subscription option "Intra-CUG restrictions" is not relevant.)

If the forwarding subscriber does not subscribe to the CUG Supplementary Service, then the call shall be forwarded (without any CUG data).

In all other cases, the call shall be rejected.

1.6.82.2 Call forwarding on mobile subscriber busy

Same as the interaction with call forwarding unconditional.

1.6.82.3 Call forwarding on no reply

Same as the interaction with call forwarding unconditional.

1.6.82.4 Call forwarding on mobile subscriber not reachable

Same as the interaction with call forwarding unconditional.

1.6.83.1 Call waiting

No interaction. If the incoming (waiting) call is a CUG call it shall be indicated as such.

1.6.84.1 Multi-party service

No interaction. Multi-party calls shall be set up taking into account the CUG relationships between the controlling party and each of the remote parties. The CUG restrictions need not to be checked between remote parties.

1.6.88 Call restriction Supplementary Services

Except for ACR, the following is valid:

- The call restriction Supplementary Services, when active and operative, takes precedence over the CUG restrictions.

- The activation of a call restriction Supplementary Service does not affect any current CUG call.

For ACR, see 3GPP TS 22.088 [6].

1.7 Interworking considerations

If, due to an interworking situation, signalling in the network is not able to carry the information required to provide the service, the network shall terminate the attempt and return an appropriate indication to the calling user. However, a CUG call with an OA indication shall in this case continue to be established as a normal call.

The rejection of CUG calls cannot be technically guaranteed in all network interconnection cases, and can only be ensured by inter-connect agreement.

Management of CUG spanning over multiple networks:

A CUG may span over several networks. In this case the responsibility for the management of this CUG is in one of these networks.

NOTE: One mechanism exists for CUGs spanning over data networks only, having X.121 as the numbering plan (see ITU-T Recommendation X.180 (1988)), "Administrative arrangements for international closed user groups".

Annex 1 (normative):
General subscription options (Per Subscriber)

Subscription Option	Values Available
Subscription to CUGs	List of one or more CUG indices to the maximum stated in subclause 1.2.1.
Intra CUG restrictions (for each CUG)	- None designated - Incoming calls barred within a CUG - Outgoing calls barred within a CUG
Applicability to Basic Services (for each CUG)	- List of one or more Basic Service groups - All Basic Services

Per basic service group subscription options

Subscription Option	Values Available
Preferential CUG	- None designated (NOTE) - CUG index
Type of inter CUG accessibility	- None designated - Outgoing access - Incoming access - Outgoing and Incoming access

Annex 2 (normative):
Originating PLMN actions on call requests on the calling user's side

Calling user's subscription - - -	Information from the calling user				
	No CUG info	CUG index or CUG index and suppress pref. CUG	Suppress OA	Suppress pref. CUG	CUG index and suppress OA or CUG index and suppress OA and suppress pref CUG
User without preferential CUG and without OA	Reject call	Establish call using CUG index provided	Reject call	Reject call	Establish call using CUG index provided
User with preferential CUG but without OA	Establish call using pref CUG	Establish call using CUG index provided	Establish call using pref CUG	Reject call	Establish call using CUG index provided
User without preferential CUG but with OA	Establish call without any CUG info i.e. a normal call	Establish call using CUG index provided and OA indicator	Reject call	Establish call without any CUG info i.e. a normal call	Establish call using CUG index provided
User with preferential CUG and with OA	Establish call using pref CUG and OA indicator	Establish call using CUG index provided and OA indicator	Establish call using pref CUG	Establish call without any CUG info i.e. a normal call	Establish call using CUG index provided
User without the CUG SS	Normal call	Normal call	Normal call	Normal call	Normal call

NOTE 1: If a CUG user enters a non-allocated CUG index the call shall be rejected.

NOTE 2: If a user, subscribing to the CUG Supplementary Service and having the OA capability, originates a call and enters a CUG index (without suppressing the OA capability), while having the restriction of outgoing calls barred within that CUG, the call shall be established without any CUG information i.e. as a normal call.

Annex 3 (normative): Terminating PLMN actions

This table shows the type of call request sent to the destination user or that a rejection indication is returned to the calling user, as a result of the CUG checks on the destination network side.

Network actions on call requests on the called user's side

Type of CUG indication from the network	M or NM	CUG attributes of the forwarding user for requested basic service group				forwarding user is a non CUG user
		IA not allowed		IA allowed		
		not icb	icb	not icb	icb	
CUG call with no OA indication	M	CUG call	rejected	CUG call	rejected	rejected
	NM	rejected		rejected		
CUG call with OA indication	M	CUG call	rejected	CUG call	normal call	normal call
	NM	rejected		normal call		
Normal call	--	rejected		normal call		normal call

M: match with any of the called subscriber's CUGs for the requested basic service group.

NM: no match with any of the called subscriber's CUGs for the requested basic service group.

Annex 4 (normative):
CUG interaction with the call forwarding Supplementary Services

This table shows under what circumstances a call shall be allowed to be forwarded.

Type of CUG indication from the network	M or NM 1)	CUG attributes of the forwarding user for requested basic service group				forwarding user is a non CUG user
		OA not allowed		OA allowed		
		not ocb	ocb	not ocb	ocb	
CUG call with no OA indication	M	CF	rejected	CF	rejected	rejected
	NM	rejected		rejected		
CUG call with OA indication	M	CFm 2)	rejected	CF	CFn	CF
	NM	rejected		CF 3)		
Normal call	--	rejected		CF 3)		CF

Abbreviations:

CF: Forward call using the calling subscriber's parameters

CFm: Forward call using modified calling subscriber's parameters

CFn: The call is forwarded as a normal call.

NOTE 1: M: match with any of the called subscriber's CUGs for the requested basic service group.

NM: no match with any of the called subscriber's CUGs for the requested basic service group.

NOTE 2: Only the interlock code is sent from the forwarding subscriber towards the forwarded to subscriber.

NOTE 3: The subscription option outgoing calls barred within a CUG (ocb), is not relevant in this case.

Annex 5 (informative):
Change history

TSG SA#	SA Doc.	SA1 Doc	Spec	CR	R ev	Rel	Cat	Subject/Comment	Old	New	WI
								Change history			
Jun 1999			GSM 02.85					Transferred to 3GPP SA1	7.0.0		
SA#04			22.085			R99		Transferred to 3GPP SA1		3.0.0	
SP-05	SP-99479	S1-99632	22.085	001		R99	D	Editorial changes for alignment	3.0.0	3.0.1	Editorial changes
SP-06	SP-99519	S1-99999	22.085	002		R99	D	Editorial update for GSM/3GPP use.	3.0.1	3.1.0	
SP-11	SP-010065	S1-010258	22.085			Rel-4		Transferred to 3GPP Release 4	3.1.0	4.0.0	
SP-15	SP-020045	S1-020457	22.085	003	-	Rel-4	F	Editorial CR to correct terms and references	4.0.0	4.1.0	CORRECT
SP-16	SP-020267	S1-021043	22.085			Rel-5		Updated from Rel-4 to Rel5	4.1.0	5.0.0	
SP-26	SP-040744	S1-040997	22.085			Rel-6		Updated from Rel-5 to Rel-6	5.0.0	6.0.0	
SP-36			22.085			Rel-7		Updated from Rel-6 to Rel-7	6.0.0	7.0.0	
SP-42	-	-				Rel-8		Updated from Rel-7 to Rel-8	7.0.0	8.0.0	
SP-46	-	-	-	-	-	-	-	Updated to Rel-9 by MCC	8.0.0	9.0.0	
2011-03	-	-	-	-	-	-	-	Update to Rel-10 version (MCC)	9.0.0	10.0.0	
SP-52	SP-110376	S1-111408	22.085	0004	-	Rel-11	B	Addition of Anonymous Call Rejection as a SS	10.0.0	11.0.0	ACR_CS
2014-10	-	-	-	-	-	-	-	Update to Rel-12 version (MCC)	11.0.0	12.0.0	
2015-12	-	-	-	-	-	-	-	Updated to Rel-13 by MCC	12.0.0	13.0.0	

History

Document history		
V13.0.0	January 2016	Publication